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DETERMINATION OF THE METHANE MAKE ON 9 EAST LONGWALL FACE USING SF_6 DERIVED AIRFLOWS

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by

L.A. Chiasson* and A.W. Stokes**

SUMMARY

This report documents a determination of face liberated methane from 9 East longwall in Lingan Colliery. These values will provide an update to existing ones and will enable better planning for the proposed Lingan Mine Extension Project. Airflows used in these calculations were measured using a tracer gas technique, providing a better level of accuracy than has been obtained previously. As a result, computed values for face liberated methane per tonne of coal cut vary considerably from existing figures.

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DÉTERMINATION DES ÉMISSIONS DE MÉTHANE DU FRONT DE TAILLE DE LA GALERIE 9E EXPLOITÉE PAR LONGUE TAILLE À L'AIDE DE GAZ TRACEUR SF_6 DANS LES COURANTS D'AIR

par

L.A Chiasson* et A.W. Stokes**

RÉSUMÉ

Ce rapport présente les résultats de la détermination des émissions de méthane provenant du front taille de la galerie 9E, exploitée par longue taille, à la houillère Lingan. Les indices obtenus de cette détermination serviront à mettre à jour des données actuelles et permettront d'effectuer une meilleure planification dans le cadre du projet d'extension de la mine Lingan. Les courants d'air utilisés lors de ces calculs ont été mesurés à l'aide d'une méthode au gaz traceur. Cette méthode par rapport aux méthodes antérieures permet d'obtenir un degré de précision plus élevé. Par conséquent, les indices calculés pour les émissions de méthane du front taille par tonne de charbon exploité diffèrent considérablement des données numériques actuelles.

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INTRODUCTION

Methane released from coal on longwall faces in Cape Breton Development Corporation's (CBDC) Lingan Colliery creates a serious operational problem. Periods of intensive mining can cause the concentrations of methane at the return end of the face and along lengths of the return gateroad to exceed statuatory requirements (1.25%). This causes power to be automatically removed from the face with a consequent loss of production. In order to minimize these production losses and provide a safe equitable working environment an optimum planned utilization of the available ventilation air is required. This will be especially important for the planned Lingan Colliery mine extension down to the 1200m contour.

To optimize the ventilation a good understanding of the volumes of face liberated methane which can be expected in future longwall panels is required. As the volumes of methane contained within a coal block vary with depth of cover and geology it is necessary to instigate an ongoing study to project the location of the methane isoplaths. Values for the face liberated methane per tonne of coal cut in Lingan Colliery are periodically calculated by CBDC. The preferred method for obtaining these values has been to use the continuous record of methane concentrations at the return end of the face provided by the BMI monitor. Weekly charts have been digitized to find the area underneath the curve and hence the average methane concentration for the week. When multiplied by the face airflow the volume of methane released on the face can be deduced. Values for the face airflow used in these calculations may have been in error up to 45 percent due to an inaccurate technique in using vane anemometers in confined areas (1).

This document records the values obtained from a first attempt to calculate face liberated methane per tonne of coal cut from 9 East Longwall using the more accurate tracer gas determined face airflows and a computerized method for measuring the average methane concentrations from the BMI tapes.

CALCULATION OF THE VOLUMES OF FACE LIBERATED METHANE

In calculating the volume of methane released on the face per tonne of coal cut for each shift the following values are required:

(a) Average concentration of methane in the intake airflow

(b) Average concentration of methane at the return end of the face

(c) Average face airflow throughout the week

(d) Tonnage of coal cut per shift

AVERAGE METHANE CONCENTRATION IN THE INTAKE AIRFLOW

The average methane concentration in the intake airflow to the face of Lingan Colliery's 9 East Longwall was determined to be 0.15 percent from a survey conducted by the Cape Breton Coal Research Laboratory (CBCRL) (2) and was found to be 0.1 percent from CBDC's records (3).

AVERAGE METHANE CONCENTRATION AT THE RETURN END OF THE FACE

A BMI recorder located at the return end of 9 East's face provided the necessary information about methane concentrations for most of the month of April through to the end of June. Some of the weekly recordings were spoiled due to unclear pen markings and inconsistencies with the tractor feed mechanisms and so the best four complete weeks of data were selected for analysis.

The areas underneath these curves were measured on a shift by shift basis. A NUMONICS digitizing tablet and pen was used to pick points off the charts and these were processed by a TEKTRONIX 4052 microcomputer which provided areas in percent hours and average methane concentrations for the shift. Figure 1 shows the original BMI charts recording for the afternoon shift of April 9 and the computer reproduced version with the corresponding analysis.

AVERAGE FACE AIRFLOW THROUGHOUT THE WEEK

Tracer gas was used to measure the airflow at the return end of the face using a procedure described elsewhere (4). This was measured to be 13.5 m^3/s flowing past the BMI monitor. This single measurement was used in all calculations for the two months of chart readings that were processed.

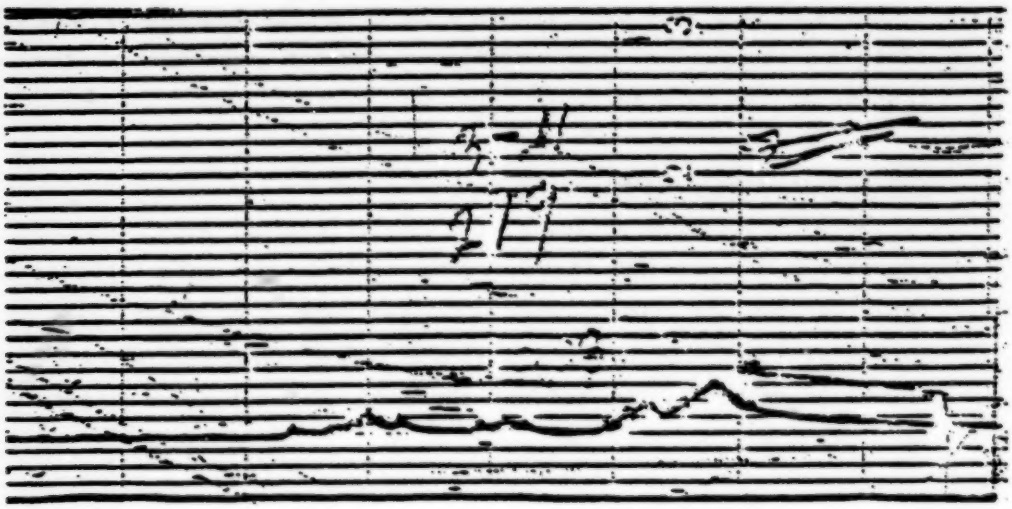
Scrutiny of the mine ventilation records showed that there was no appreciable change in the face quantity during this period. This was to be expected since there were no major adjustments made to the mine ventilation and the high resistance of 9 East (it is a long ventilation split) makes it unsusceptible to changes in face resistance through movement of the supports and changes at the face ends.

TONNAGE OF COAL CUT PER SHIFT

Production figures for this period were obtained from CBDC records. Two sets of figures were used in the calculations; one used the reported run of mine (ROM) tonnages and the other used cleaned coal tonnages. Appendix 1 shows a sample calculation performed to determine the volume of methane liberated per tonne of coal cut for the afternoon shift on April 9.

RESULTS

In the following tables (1-10) values for total production, total volumes of methane released at the face and average volumes of methane released per tonne of coal cut have been tabulated for each week as well as for the overall four-week period. These figures were determined using both 0.1 and 0.15 percent as the methane concentration in the intake airflow to the face. Cleaned coal and ROM tonnages were used in the calculations and the total volume of methane released from the face was determined both including "non-production" gas and excluding "non-production" gas ("non-production" gas is covered in the discussion). Appendix A gives a set of sample calculations for the afternoon shift of April 9.



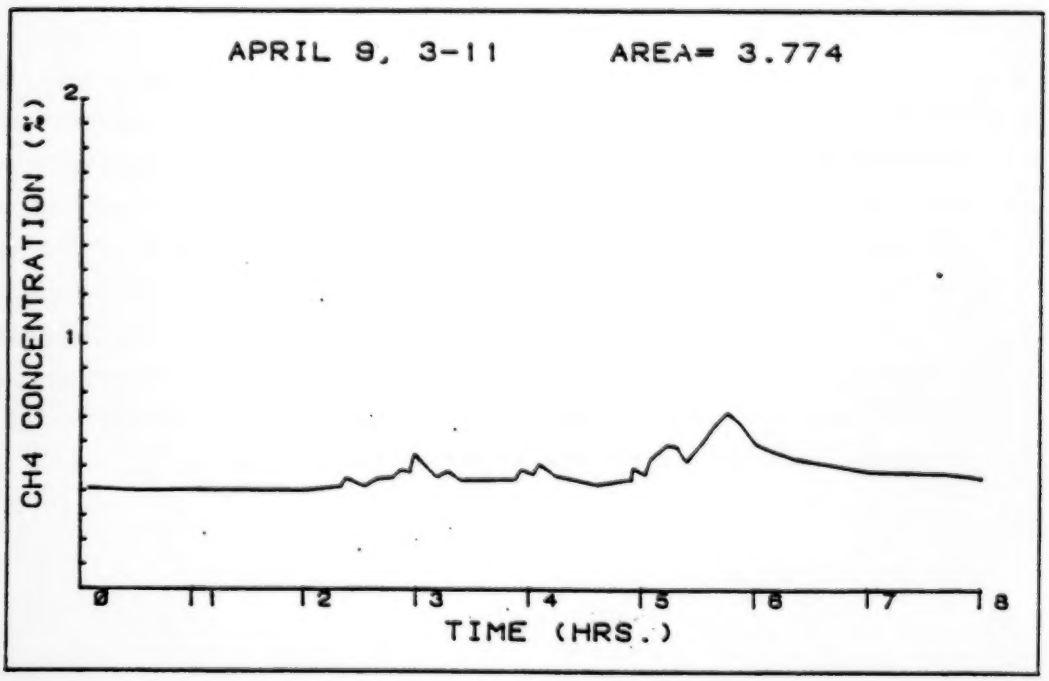


Fig. 1 - The actual and computerized version of the BMI Chart for April 9

Table 1. ROM, Week 1, Using 0.1% as the Background Level of Methane

DATE	TIME (SHIFT)	AREA (AMR.)	AV.% (CH4)	CORR. AV. % (-0.1%)	PROD. (TON)	CH4/S (M**3.S)	TOT. CH4 (M**3)	CH4/TON (M**3/TON)
07-Apr-86	07:00 AM	2.7673	0.3459	0.2459	341	0.00320	956.11	2.795e
07-Apr-8a	03:00 PM	3.1024	0.4128	0.3128	341	0.04222	1216.17	3.55e0
07-Apr-8c	11:00 PM	4.2760	0.5048	0.4047	682	0.05569	1e90.31	2.4743
08-Apr-86	07:00 AM	4.3693	0.5487	0.4487	673	0.0e057	1744.51	2.5921
08-Apr-8e	03:00 PM	3.6762	0.4595	0.3595	302	0.04654	1397.82	4.2107
08-Apr-8c	11:00 PM	4.0736	0.5092	0.4092	659	0.05525	1591.07	2.4144
09-Apr-8e	07:00 AM	3.0375	0.3797	0.2797	22	0.03776	1087.62	49.4372
09-Apr-8a	03:00 PM	3.7742	0.4718	0.3718	219	0.05019	1445.46	6.6027
09-Apr-8c	11:00 PM	4.3620	0.5451	0.4451	659	0.06011	1731.13	2.6269
10-Apr-8e	07:00 AM	3.7268	0.4658	0.3658	529	0.04938	1422.25	2.6883
10-Apr-8a	03:00 PM	3.5197	0.4399	0.3399	34e	0.04586	1321.37	3.8179
10-Apr-8c	11:00 PM	3.5331	0.4479	0.3479	667	0.04e76	1352.59	2.0218
11-Apr-8e	07:00 AM	2.9e24	0.3703	0.2703	55	0.03e49	1050.93	19.1078
11-Apr-8a	03:00 PM	3.5313	0.4414	0.3414	625	0.(4e09	1327.41	2.1237
11-Apr-8c	11:00 PM	3.8894	0.4861	0.3861	1039	0.05213	1501.25	1.4449
12-Apr-8e	07:00 AM	2.9976	0.3747	0.2747	MAINT	0.03706	1e66.03	------
12-Apr-8a	03:00 PM	2.6075	0.3259	0.1259	MAINT	0.03050	878.44	------
12-Apr-8c	11:00 PM	2.4071	0.3009	0.2009	MAINT	0.02712	781.05	------
13-Apr-8e	07:00 AM	2.4338	0.3045	0.2045	MAINT	0.027e0	793.00	------
13-Apr-8a	03:00 PM	2.2550	0.2819	0.1819	MAINT	0.02455	707.13	------
13-Apr-8c	11:00 PM	2.2e23	0.2828	0.1828	MAINT	0.024e3	710.78	------

	TOT.PROD.	TOT. CH4	AVERAGE CH4 TON
(INCLUDING NON-PRODUCTION SHIFTS)	7197	2577e.48	3.58.e
(EXCLUDING NON-PRODUCTION SHIFTS)	7197	2e33s.03	2.8921

Table 2. ROM, Week 2, Using 0.1% as the Background Level of Methane

	14-Apr-86	07:00 AM	2.0174	0.2522	0.1522	MAINT	0.02054	391.66	------
	14-Apr-86	03:00 PM	2.5157	0.3145	0.2145	346	0.02575	833.83	2.4099
	14-Apr-86	11:00 PM	3.3367	0.4171	0.3171	687	0.04251	1232.93	1.8052
	15-Apr-86	07:00 AM	2.5387	0.3236	0.2236	MAINT	0.03019	869.41	------
	15-Apr-86	03:00 PM	4.3926	0.5492	0.4492	688	0.06054	1746.49	2.5385
	15-Apr-86	11:00 PM	5.0450	0.6306	0.5306	717	0.07165	2063.07	2.8774
	16-Apr-86	07:00 AM	3.8274	0.4784	0.3784	MAINT	0.05109	1471.32	------
	16-Apr-86	03:00 PM	4.6657	0.5832	0.4832	303	0.05511	1587.13	5.2351
	16-Apr-86	11:00 PM	4.9729	0.6216	0.5216	1020	0.07042	2028.05	1.9882
	17-Apr-86	07:00 AM	3.3195	0.4149	0.3149	10	0.04252	1224.48	122.4477
	17-Apr-86	03:00 PM	4.1428	0.5179	0.4179	678	0.05641	1624.60	2.3962
	17-Apr-86	11:00 PM	3.0171	0.3771	0.2771	MAINT	0.03741	1077.51	------
	18-Apr-86	07:00 AM	2.9287	0.3661	0.2661	67	0.03592	1034.56	15.4411
	18-Apr-86	03:00 PM	3.9772	0.4972	0.3972	808	0.05362	1544.12	1.9110
	18-Apr-86	11:00 PM	3.8748	0.4843	0.3843	491	0.05185	1494.24	3.0427
	19-Apr-86	07:00 AM	2.9814	0.3884	0.2884	MAINT	0.03830	1048.58	------
	19-Apr-86	03:00 PM	2.8504	0.3563	0.2563	MAINT	0.03460	996.49	------
	19-Apr-86	11:00 PM	3.0160	0.3770	0.2770	MAINT	0.03740	1076.98	------
	20-Apr-86	07:00 AM	* 2.8000	0.3500	0.2500	MAINT	0.03375	972.00	------
	20-Apr-86	03:00 PM	* 2.6000	0.3250	0.2250	MAINT	0.03038	874.80	------
	20-Apr-86	11:00 PM	* 2.5000	0.3125	0.2125	MAINT	0.02869	826.20	------

* ESTIMATED FIGURES

	TOT.PROD.	TOT. CH4	AVERAGE CH4/TON
(INCLUDING NON-PRODUCTION SHIFTS)	5811	2621.44	4.5113
(EXCLUDING NON-PRODUCTION SHIFTS)	5811	1641.49	2.8245

Table 3. ROM, Week 3, Using 0.1% as the Background Level of Methane

DATE	TIME (Shift)	AREA (%Hr.)	AV.% (%CH4)	CORR. AV. % (-0.1%)	PROD. (TON)	CH4/S (M^3/S)	TOT. CH4 (M^3)	CH4/TON (M^3/TON)
21-Apr-86	07:00 AM	2.5946	0.3243	0.2243	1074	0.03022	871.16	0.81121
21-Apr-86	03:00 PM	3.9296	0.4925	0.3925	1042	0.05278	1523.94	1.46248
21-Apr-86	11:00 PM	4.3823	0.5478	0.4478	MAINT	0.06045	1741.00	------
22-Apr-86	07:00 AM	5.0425	0.6303	0.5303	1633	0.07154	2061.89	1.26251
22-Apr-86	03:00 PM	5.3795	0.6724	0.5724	1270	0.07723	2225.94	1.75272
22-Apr-86	11:00 PM	3.1141	0.3893	0.2893	MAINT	0.03905	1124.85	------
23-Apr-86	07:00 AM	4.4861	0.5608	0.4608	1019	0.06220	1791.44	1.75820
23-Apr-86	03:00 PM	4.6231	0.5554	0.4554	810	0.06257	1887.19	2.32951
23-Apr-86	11:00 PM	3.3461	0.4183	0.3183	MAINT	0.04297	1237.40	------
24-Apr-86	07:00 AM	4.5485	0.5686	0.4686	1015	0.06328	1821.77	1.79531
24-Apr-86	03:00 PM	4.1839	0.5229	0.4229	840	0.05709	1644.14	1.95731
24-Apr-86	11:00 PM	3.2725	0.4091	0.3091	MAINT	0.04172	1201.64	------
25-Apr-86	07:00 AM	4.2181	0.5273	0.4273	736	0.05762	1661.20	2.25711
25-Apr-86	03:00 PM	4.5435	0.6055	0.5055	1026	0.06824	1965.19	1.91514
25-Apr-86	11:00 PM	3.4103	0.4263	0.3263	MAINT	0.04405	1269.61	------
21-Jun-86	07:00 AM	2.3729	0.2591	0.2591	MAINT	0.03498	1007.47	------
21-Jun-86	03:00 PM	2.3566	0.2946	0.1946	MAINT	0.02627	756.91	------
21-Jun-86	11:00 PM	2.1717	0.2715	0.1715	MAINT	0.02315	666.85	------
22-Jun-86	07:00 AM	2.0782	0.2598	0.1598	MAINT	0.02157	621.21	------
22-Jun-86	03:00 PM	2.1778	0.2722	0.1722	MAINT	0.02325	669.61	------
22-Jun-86	11:00 PM	2.1906	0.2739	0.1738	MAINT	0.02347	675.93	------

	TOT.PROD.	TOT. CH4	4.2F4.2E CH4/TON
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(INCLUDING NON-PRODUCTION SHIFTS)	10266	28427.19	2.7691
(EXCLUDING NON-PRODUCTION SHIFTS)	10266	17459.35	1.7014

Table 4. ROM, Week 4, Using 0.1% as the Background Level of Methane

DATE	TIME (SHIFT)	AREA (%HR.)	AV.% (%CH4)	CORR. AV. % (-0.1%)	PROD. (TON)	CH4/S (M^3/S)	TOT. CH4 (M^3)	CH4/TON (M^3/TON)
23-Jun-86	07:00 AM	3.6739	0.4592	0.3592	1024	0.04850	1396.72	1.3640
23-Jun-86	03:00 PM	4.1568	0.5196	0.4196	828	0.05663	1631.40	1.9702
23-Jun-86	11:00 PM	2.6306	0.3538	0.2538	MAINT	0.03427	986.87	------
24-Jun-86	07:00 AM	4.6567	0.5821	0.4821	1352	0.06508	1874.36	1.3864
24-Jun-86	03:00 PM	3.0133	0.3767	0.2767	284	0.03735	1075.66	3.7878
24-Jun-86	11:00 PM	2.2506	0.2813	0.1813	MAINT	0.02448	704.99	------
25-Jun-86	07:00 AM	3.9855	0.4982	0.3982	1125	0.05378	1548.15	1.3761
25-Jun-86	03:00 PM	3.8697	0.4837	0.3837	897	0.05180	1491.87	1.6632
25-Jun-86	11:00 PM	2.7550	0.3444	0.2444	MAINT	0.03299	950.13	------
26-Jun-86	07:00 AM	4.6186	0.5773	0.4773	* 1325	0.06444	1855.84	------
26-Jun-86	03:00 PM	5.0233	0.6279	0.5279	* 1275	0.07127	2051.52	------
26-Jun-86	11:00 PM	2.5460	0.3183	0.2182	MAINT	0.02946	848.56	------
27-Jun-86	07:00 AM	4.5848	0.5731	0.4731	1561	0.06387	1839.41	1.1784
27-Jun-86	03:00 PM	4.4222	0.5528	0.4528	1269	0.06112	1760.39	1.3867
27-Jun-86	11:00 PM	2.3554	0.2944	0.1944	MAINT	0.02625	755.52	------
28-Jun-86	07:00 AM	2.3893	0.2987	0.1987	MAINT	0.02682	772.40	------
28-Jun-86	03:00 PM	2.3642	0.2955	0.1955	MAINT	0.02640	760.20	------
28-Jun-86	11:00 PM	1.9498	0.2437	0.1437	MAINT	0.01940	558.80	------
29-Jun-86	07:00 AM	2.9934	0.2617	0.1617	MAINT	0.02183	629.59	------
29-Jun-86	03:00 PM	1.9911	0.2489	0.1489	MAINT	0.02010	578.87	------
29-Jun-86	11:00 PM	1.9418	0.2427	0.1427	MAINT	0.01927	554.91	------

* ESTIMATED FIGURES

	TOT.PROD.	TOT. CH4	AVERAGE CH4/TON
(INCLUDING NON-PRODUCTION SHIFTS)	10960	24026.36	2.2470
(EXCLUDING NON-PRODUCTION SHIFTS)	10960	16526.32	1.5079

	OVERALL TOT.PROD.	OVERALL TOT. CH4	OVERALL AVERAGE CH4/TON
(INCLUDING NON-PRODUCTION SHIFTS)	34234	105045.67	3.0685
(EXCLUDING NON-PRODUCTION SHIFTS)	34234	71232.41	2.0805

Table 5. ROM, Week 1, Using 0.15% as the Background Level of Methane

DATE	TIME (SHIFT)	AREA (%HR.)	Av.% (%CH4)	CORR. AV. % (-0.15%)	PROD. (TON)	CH4/S (M**3/S)	TOT. CH4 (M**3)	CH4/TON (M**3/TON)
07-Apr-86	07:00 AM	2.7673	0.3459	0.1959	342	0.01645	761.71	2.2271
07-Apr-86	03:00 PM	3.3024	0.4128	0.2628	341	0.02348	1021.77	2.9971
07-Apr-86	11:00 PM	4.2780	0.5348	0.3848	363	0.03194	1495.91	4.1221
08-Apr-86	07:00 AM	4.3893	0.5487	0.3987	370	0.03561	1550.10	4.1895
08-Apr-86	03:00 PM	3.6782	0.4598	0.3098	332	0.04179	1202.42	3.6248
08-Apr-86	11:00 PM	4.0738	0.5092	0.3592	359	0.04650	1396.87	3.8894
09-Apr-86	07:00 AM	3.0379	0.3797	0.2297	22	0.00191	843.22	-1.6309
09-Apr-86	03:00 PM	3.7742	0.4718	0.3218	219	0.04344	1251.06	5.7126
09-Apr-86	11:00 PM	4.3620	0.5453	0.3953	339	0.05036	1536.73	4.5341
10-Apr-86	07:00 AM	3.7265	0.4658	0.3158	329	0.04263	1227.66	3.7321
10-Apr-86	03:00 PM	3.5187	0.4399	0.2899	346	0.03913	1128.99	3.2572
10-Apr-86	11:00 PM	3.5831	0.4479	0.2979	366	0.04021	1158.19	3.1712
11-Apr-86	07:00 AM	2.9624	0.3703	0.2203	33	0.02974	858.33	15.8732
11-Apr-86	03:00 PM	3.5313	0.4414	0.2914	328	0.03934	1133.91	3.5942
11-Apr-86	11:00 PM	3.8897	0.4862	0.3361	1009	0.04538	1306.85	1.2975
12-Apr-86	07:00 AM	2.9976	0.3747	0.2247	MAINT	0.03033	870.81	------
12-Apr-86	03:00 PM	2.6075	0.3259	0.1759	MAINT	0.02375	684.05	------
12-Apr-86	11:00 PM	2.4071	0.3009	0.1509	MAINT	0.02037	586.85	------
13-Apr-86	07:00 AM	2.4356	0.3045	0.1545	MAINT	0.02088	600.60	------
13-Apr-86	03:00 PM	2.2550	0.2819	0.1319	MAINT	0.01780	512.72	------
13-Apr-86	11:00 PM	2.2423	0.2803	0.1303	MAINT	0.01757	5.5.35	------

	TOT.PROD.	TOT. CH4	AVERAGE CH4/TON
(INCLUDING NON-PRODUCTION SHIFTS)	7197	21694.09	3.0145
(EXCLUDING NON-PRODUCTION SHIFTS)	7197	17910.03	2.4877

Table 6. RCM, Week 2, Using 0.15% as the Background Level of Methane

DATE	TIME (SHIFT)	AREA (%HR.)	AV.% (%CH4)	CORR. AV. % (-0.15%)	PROD. (TON)	CH4/S (M^3/S)	TOT. CH4 (M^3)	CH4/TON (M^3/TON)
14-Apr-86	07:00 AM	2.0174	0.2522	0.1022	MAINT	0.01379	397.28	------
14-Apr-86	03:00 PM	2.5157	0.3145	0.1645	346	0.02220	639.43	1.8481
14-Apr-86	11:00 PM	3.3369	0.4171	0.2671	683	0.03606	1038.33	1.5205
15-Apr-86	07:00 AM	2.5869	0.3236	0.1736	MAINT	0.02344	675.01	------
15-Apr-86	03:00 PM	4.3936	0.5492	0.3992	688	0.05387	1551.09	2.2557
15-Apr-86	11:00 PM	5.0450	0.6306	0.4806	717	0.06488	1868.87	2.6061
16-Apr-86	07:00 AM	3.8274	0.4784	0.3284	MAINT	0.04434	1278.92	------
16-Apr-86	03:00 PM	4.0657	0.5082	0.3582	303	0.04836	1392.77	4.5965
16-Apr-86	11:00 PM	4.9729	0.6216	0.4716	1020	0.06367	1833.63	1.7977
17-Apr-86	07:00 AM	3.3195	0.4149	0.2649	10	0.03577	1030.08	103.0077
17-Apr-86	03:00 PM	4.1423	0.5179	0.3679	678	0.04966	1430.20	2.1095
17-Apr-86	11:00 PM	3.0171	0.3771	0.2271	MAINT	0.03066	883.11	------
18-Apr-86	07:00 AM	2.9287	0.3661	0.2161	67	0.02917	840.15	12.5395
18-Apr-86	03:00 PM	3.9772	0.4972	0.3472	806	0.04687	1349.72	1.6704
18-Apr-86	11:00 PM	3.8746	0.4843	0.3343	491	0.04513	1299.82	2.6474
19-Apr-86	07:00 AM	2.9514	0.3689	0.2189	MAINT	0.02955	851.18	------
19-Apr-86	03:00 PM	2.8504	0.3563	0.2063	MAINT	0.02783	802.09	------
19-Apr-86	11:00 PM	3.0160	0.3770	0.2270	MAINT	0.03065	882.86	------
20-Apr-86	07:00 AM	* 2.8000	0.3500	0.2000	MAINT	0.02700	777.60	------
20-Apr-86	03:00 PM	* 2.6000	0.3250	0.1750	MAINT	0.02363	680.40	------
20-Apr-86	11:00 PM	* 2.5000	0.3125	0.1625	MAINT	0.02194	631.80	------

* ESTIMATED FIGURES

	TOT.PROD.	TOT. CH4	AVERAGE CH4/TON
(INCLUDING NON-PRODUCTION SHIFTS)	5811	22133.04	3.8088
(EXCLUDING NON-PRODUCTION SHIFTS)	5811	14275.09	2.4566

Table 7. ROM, Week 3, Using 0.15% as the Background Level of Methane

DATE	TIME (SHIFT)	AREA (%HR.)	AV.% (%CH4)	CORR. AV. % (-0.15%)	PROD. (TON)	CH4/S (M^3/S)	TOT. CH4 (M^3)	CH4/TON (M^3/TON)
21-Apr-86	07:00 AM	2.5946	0.3243	0.1743	1074	0.02353	677.78	0.6311
21-Apr-86	03:00 PM	3.4378	0.4925	0.3425	1042	0.04622	1331.54	1.2778
21-Apr-86	11:00 PM	4.3623	0.5478	0.3978	MAINT	0.05370	154a.60	-------
22-Apr-86	07:00 AM	5.0425	0.6303	0.4803	1630	0.06484	1867.46	1.1456
22-Apr-86	03:00 PM	5.3795	0.6724	0.5224	1270	0.07053	2031.24	1.5994
22-Apr-86	11:00 PM	3.1141	0.3893	0.2393	MAINT	0.03230	930.25	-------
23-Apr-86	07:00 AM	4.4861	0.5a08	0.4108	1019	0.05545	1597.04	1.5a7C
23-Apr-86	03:00 PM	4.6871	0.5854	0.4354	810	0.05878	1692.79	2.0899
22-Apr-86	11:00 PM	3.3461	0.4183	0.2683	MAINT	0.03622	1043.00	-------
24-Apr-86	07:00 AM	4.5485	0.5686	0.4186	1016	0.05a51	1627.37	1.6a.7
24-Apr-86	03:00 PM	4.1830	0.5229	0.3729	840	0.05134	1469.74	2.1852
24-Apr-3a	11:00 PM	3.2725	0.4091	0.2591	MAINT	0.03497	1007.24	-------
25-Apr-86	07:00 AM	4.2151	0.5273	0.3773	776	0.05093	14ca.80	1.9329
25-Apr-86	03:00 PM	4.8426	0.6a5E	0.4555	1026	0.06149	1770.79	1.7259
25-Apr-3a	11:00 PM	3.4103	0.4263	0.2763	MAINT	0.03730	1074.21	-------
21-Jun-8a	07:00 AM	2.8729	0.3591	0.2091	MAINT	0.02823	813.03	-------
21-Jun-8a	03:00 PM	2.35aa	0.2946	0.1446	MAINT	0.01952	5a2.11	-------
21-Jun-8a	11:00 PM	2.17.7	0.2715	0.1215	MAINT	0.01a40	472.2E	-------
22-Jun-8a	07:00 AM	2.0782	0.2598	0.1098	MAINT	0.01482	42a.81	-------
22-Jur-8a	03:00 PM	2.1778	0.2722	0.1222	MAINT	0.01651	475.21	-------
22-Jur-8a	11:00 PM	2.1903	0.2739	0.1238	MAINT	0.01672	48..33	-------

	TOT.PROD.	TOT. CH4	AVER.CH4/TON
(INCLUDING NON-PRODUCTION SHIFTS)	10280	24744.79	2.37.4
(EXCLUDING NON-PRODUCTION SHIFTS)	10200	1E8:2.55	1.8...

Table 8. ROM, Week 4, Using 0.15% as the Background Level of Methane

DATE	TIME (SHIFT)	AREA (LAM.)	AV.% (%CH4)	CORR. AV. % (-0.15%)	PROD. (TON)	CH4/S (M^3/S)	TOT. CH4 (M^3)	CH4/TON (M^3/TON)
23-Jun-86	07:00 AM	3.6739	0.4592	0.3092	1024	0.04175	1202.32	1.1741
23-Jun-86	03:00 PM	4.1568	0.5196	0.3696	828	0.04990	1437.00	1.7355
23-Jun-86	11:00 PM	2.6306	0.3538	0.2038	MAINT	0.02752	792.47	------
24-Jun-86	07:00 AM	4.6567	0.5821	0.4321	1151	0.05833	1679.96	1.4626
24-Jun-86	03:00 PM	3.0130	0.3767	0.2267	284	0.03060	881.28	3.1030
24-Jun-86	11:00 PM	2.2508	0.2813	0.1313	MAINT	0.01773	510.59	------
25-Jun-86	07:00 AM	3.9685	0.4961	0.3462	1125	0.04701	1353.75	1.2033
25-Jun-86	03:00 PM	3.5697	0.4637	0.3337	697	0.04505	1297.47	1.4465
25-Jun-86	11:00 PM	2.7550	0.3444	0.1944	MAINT	0.02624	755.73	------
26-Jun-86	07:00 AM	4.6186	0.5773	0.4273	* 1325	0.05769	1661.44	------
26-Jun-86	03:00 PM	5.0233	0.6279	0.4779	* 1275	0.06452	1858.12	------
26-Jun-86	11:00 PM	2.5460	0.3183	0.1683	MAINT	0.02271	654.16	------
27-Jun-86	07:00 AM	4.5845	0.5731	0.4231	1561	0.05712	1645.01	1.0535
27-Jun-86	03:00 PM	4.4222	0.5528	0.4028	1269	0.05437	1565.99	1.2149
27-Jun-86	11:00 PM	2.3554	0.2944	0.1444	MAINT	0.01950	561.52	------
28-Jun-86	07:00 AM	2.3893	0.2987	0.1487	MAINT	0.02007	578.00	------
28-Jun-86	03:00 PM	2.3642	0.2955	0.1455	MAINT	0.01965	565.80	------
28-Jun-86	11:00 PM	1.9492	0.2437	0.0937	MAINT	0.01265	364.40	------
29-Jun-86	07:00 AM	2.6934	0.2817	0.1117	MAINT	0.01506	434.19	------
29-Jun-86	03:00 PM	1.9911	0.2489	0.0989	MAINT	0.01335	384.47	------
29-Jun-86	11:00 PM	1.9418	0.2427	0.0927	MAINT	0.01252	360.51	------

* ESTIMATED FIGURES

	TOT.PROD.	TOT. CH4	AVERAGE CH4/TON
(INCLUDING NON-PRODUCTION SHIFTS)	10960	20544.16	1.8745
(EXCLUDING NON-PRODUCTION SHIFTS)	10960	14582.32	1.3306

	OVERALL TOT.PROD.	OVERALL TOT. CH4	OVERALL AVERAGE CH4/TON
(INCLUDING NON-PRODUCTION SHIFTS)	34234	88716.08	2.5918
(EXCLUDING NON-PRODUCTION SHIFTS)	34234	62290.01	1.8195

Table 9. Clean Coal, Using 0.15% as the Background Level of Methane

DATE	AREA (%HR.)	AV.% (%CH4)	CORR. AV. % (-0.1%)	PROD. (TON)	CH4/S (M^3/S)	TOT. CH4 (M^3)	CH4/TON (M^3/TON)
07-Apr-86	10.3477	0.4312	0.3312	1367	0.04471	3862.58	2.8258
08-Apr-86	12.1400	0.5058	0.4058	1864	0.05479	4733.64	2.5447
09-Apr-86	11.1741	0.4656	0.3656	708	0.04935	4264.21	6.0229
10-Apr-86	10.8283	0.4512	0.3512	1544	0.04741	4096.25	2.6530
11-Apr-86	10.3527	0.4326	0.3326	1722	0.04490	3879.39	2.2530
12-Apr-86	6.0122	0.2338	0.2338	MAINT	0.03157	2727.50	------
13-Apr-86	6.9533	0.2897	0.1897	MAINT	0.02561	2212.90	------
14-Apr-86	7.8700	0.3279	0.2279	1029	0.03077	2658.42	2.5826
15-Apr-86	12.0275	0.5011	0.4011	1403	0.05415	4678.97	3.3348
16-Apr-86	12.8560	0.5356	0.4356	1323	0.05887	5086.48	3.8447
17-Apr-86	10.4794	0.4366	0.3366	683	0.04545	3926.59	5.7497
18-Apr-86	10.7805	0.4491	0.3491	1786	0.04714	4072.92	2.2810
19-Apr-86	3.5178	0.3674	0.2674	MAINT	0.03610	3119.08	------
20-Apr-86	7.9000	0.3292	0.2292	MAINT	0.03074	2678.90	------
21-Apr-86	10.9187	0.4549	0.3549	1586	0.04771	4139.12	2.6098
22-Apr-86	10.5062	0.5640	0.4640	2170	0.06264	5412.14	2.4937
23-Apr-86	12.3153	0.5215	0.4215	1771	0.05690	4916.04	2.7757
24-Apr-86	12.0040	0.5002	0.4002	1242	0.05402	4667.54	3.7581
25-Apr-86	12.4720	0.5197	0.4197	1321	0.05660	4874.99	3.7022

	TOT.PROD.	TOT. CH4	AVERAGE CH4/TON
(INCLUDING NON-PRODUCTION SHIFTS)	20512	76021.96	3.7062
(EXCLUDING NON-PRODUCTION SHIFTS)	20512	54706.28	2.6670

Table 10. Clean Coal, Using 0.15% as the Background Level of Methane

DATE	AREA (SQ.M.)	AV.% (%CH4)	CORR. AV. % (-0.15%)	PROD. (TON)	CH4/S (M**3/S)	TOT. CH4 (M**3)	CH4/TON (M**3/TON)
07-Apr-86	10.3477	0.4312	0.2812	1367	0.03796	3279.35	2.3990
08-Apr-86	12.1400	0.5058	0.3558	1694	0.04804	4150.44	2.4497
09-Apr-86	11.1741	0.4656	0.3156	708	0.04260	3681.01	5.1992
10-Apr-86	10.8285	0.4512	0.3012	1344	0.04066	3513.05	2.6135
11-Apr-86	10.3827	0.4326	0.2826	1722	0.03815	3296.39	1.9142
12-Apr-86	8.0122	0.3338	0.1838	MAINT	0.02482	2144.33	------
13-Apr-86	6.9333	0.2889	0.1389	MAINT	0.01876	1620.70	------
14-Apr-86	7.8700	0.3279	0.1779	1029	0.02402	2075.22	2.0167
15-Apr-86	12.0275	0.5011	0.3511	1403	0.04740	4095.77	2.9181
16-Apr-86	12.8661	0.5361	0.3861	1321	0.05212	4503.26	3.4085
17-Apr-86	10.4794	0.4366	0.2866	668	0.03870	3343.39	4.8579
18-Apr-86	10.7605	0.4483	0.2983	1366	0.04029	3481.72	2.5547
19-Apr-86	8.2178	0.3424	0.1924	MAINT	0.02598	2244.85	------
20-Apr-86	7.9000	0.3292	0.1792	MAINT	0.02419	2089.80	------
21-Apr-86	10.9267	0.4549	0.3049	1586	0.04116	3555.92	2.2421
22-Apr-86	13.5361	0.5640	0.4140	2176	0.05589	4828.94	2.2192
23-Apr-86	12.8133	0.5213	0.3713	1371	0.05015	4332.84	3.1603
24-Apr-86	12.0040	0.5002	0.3502	1242	0.04727	4084.34	3.2885
25-Apr-86	12.4720	0.5197	0.3697	1321	0.04991	4311.74	3.2640

	TOT.PROD.	TOT. CH4	AVERAGE CH4/TON
(INCLUDING NON-PRODUCTION SHIFTS)	20512	64941.16	3.1660
(EXCLUDING NON-PRODUCTION SHIFTS)	20512	47707.87	2.3259

DISCUSSION

Methane is released from coal over the weekends and during non-productive maintenance shifts. Two sets of values for the face methane per tonne of coal cut are given in the results; the first includes this volume of "non-production" gas in the overall averages and the second omits it from the calculations. The value derived by omitting the "non-production" gas is not one usually quoted and it is only valid for the production schedules in use at Lingan Colliery for the four-week period analyzed. Their inclusion in this report is meant only to give an indication of the actual face gas made during a production shift which may or may not be useful when considering future longwall layouts.

Examination of the shift by shift values for the volume of methane released per tonne of coal cut shows considerable variations. A general range from 1.8 to 5.0 m^3/tonne includes most values, however there are occasional high ones such as 49.4 m^3/tonne for the morning shift on April 9. This disproportionally high value is caused by the low reported figure for production during that shift which tends to cause a bias in the resultant calculations. For this reason individual results vary by up to 4000 percent from the overall averages and mean little or nothing on their own.

The range of values obtained for the ROM production figures, including the "non-production" gas and assuming a methane concentration of between 0.1 and 0.15 percent in the intake air, are from 2.6 to 3.1 m^3/tonne. The range (for the same assumptions) for cleaned coal rather than ROM are from 3.1 to 3.7 m^3/tonne. Values for ROM production figures, but not including the "non-production" gas, are from 1.8 to 2.1 m^3/tonne. Similarly for clean coal these range from 2.3 to 2.7 m^3/tonne.

This means that the possible values for the face methane per tonne of coal cut range from a minimum of 1.8 m^3/tonne to a maximum of 3.7 m^3/tonne depending on what criteria are used to define the calculation.

CONCLUSIONS

The calculated volume of methane released on 9 East's face per tonne of coal cut ROM for the four-week period of data analyzed lies in the range of 2.6 to 3.1 m^3/tonne. This range of values is somewhat less than comparable figures commonly used by CBDC (4 to 5 m^3/tonne)(5).

On average the calculated values were between 60 to 65 percent those used by CBDC. Most of this difference can probably be accounted for by the different techniques used to measure the face airflow rather than a decrease in the methane content of the coal.

It should be noted that these calculations were based on only four weeks of data which contained a large variance between individual shift values. A much larger data base is required to produce more statisically sound results. This could be achieved by a regular ongoing routine analysis of BMl charts from operating longwall faces in Lingan Colliery.

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APPENDIX A

SAMPLE CALCULATION OF METHANE PRODUCTION PER TONNE OF COAL CUT (APRIL 9)

COLUMN				
3	AREA UNDER BM1 TRACE (AS MEASURED USING TEKTRONIX)	=		3.7742 %.hr
4	AVERAGE METHANE CONCENTRATION DURING SHIFT	=	$\frac{\text{COL } 3}{8}$	= 0.4718 %
5	CORRECTED AVERAGE METHANE CONCENTRATION DUE TO THE FACE GAS	=	COL 4 - 0.1	= 0.3718 %
6	PRODUCTION TONNAGE (FROM RECORDS)			= 219 t
7	METHANE PRODUCTION FROM FACE (PER SECOND)	=	$\frac{\text{COL } 5 \times 13.5}{100}$	= 0.05019 m^3/s
8	TOTAL METHANE PRODUCED FOR SHIFT	=	COL 7 x 8 x 60 x60	= 1445.46 m^3
9	METHANE PRODUCED PER TONNE OF COAL CUT	=	$\frac{\text{COL } 8}{\text{COL } 6}$	= 6.631 m^3/t